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# A Wanted Traffic

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## Abstract

*Attention is called for the need and use of conceptual/methodological guiding structures for environmental data acquisition, so that conclusive error prone results of costly application of techniques have smaller chances of occurrence. Geoprocessing, understood as a research field dedicated to change environmental data, i.e. simple registers of occurrences, into information, i.e. meaningful gain of knowledge about the environment, is pointed as having a role in the building of the above mentioned theoretical guiding structures.*

**Keywords**: Geoprocessing, Geoinclusion, Geodiversity, Entity, Event, Vigilance, Control.

## 1. Introduction

A simple and effective approach to face environmental problems is a much sought dream. Such a task necessarily involves adequate mingling of concepts, methods and techniques, so that a convergent, integrated and useful data assemblage, i.e. an operational environmental model, is generated. Geoprocessing, as an integrative procedure dealing simultaneously with a double faced - spatial and taxonomic - research referential, is able to contribute to the creation of reasonable theoretical and practical assemblages, not only of data, but also of knowledge concerning environmental problems.

There is a growing interest in environmental research towards the so-called "geo" procedures and problems (Xavier-da-Silva and Marino, 2010), (Xavier-da-Silva and Marino, 2011). Several terms have been coined, such as Geodiversity (Xavier-da- Silva et al., in Garay and Dias, 2001), Geotopology (Xavier-da-Silva and Zaidan, 2007, p. 20) and Geoinclusion (Xavier-da-Silva and Marino, 2011), and a few will be mentioned or discussed ahead.

## 2. Some discussions about concepts

### 2.1. About Geotechnologies

The recent development of the geotechnologies has brought some advances to environmental studies, but some confusion arises from improper use of the geotechnical nomenclature. To start a discussion two contentions can be made: a) data creation does not mean generated information, and b) any action rests, axiomatically, on a referential. It follows that any gain of knowledge (information), which is necessarily originated from data (registers of occurring or imagined phenomena), comes into existence only when the pertinent data is integrated in the proper referential.

Many fields of research operate upon the Earth surface referential, aiming their data integration processes to different main objectives. All of them are rational assemblages of concepts, methods and techniques dealing with territorial data. Relevant examples are: Digital Cartography, which central aim may be considered the best possible representation of the spatial distribution of entities and events along a specified portion or the total of a referential; Global Positioning Systems, having as basic goal the identification of geographic positions; Remote Sensing, basically generating indirectly obtained images through classification of induced or natural responses of energy incidences upon phenomena; and finally, Geoprocessing, essentially an integrative procedure aimed directly to the change of data into information (Xavier-da-Silva, 2009).

### 2.2. Concepts x Techniques

It is a well-known fact that technological developments may bring relevant conceptual, methodological and technical contributions to scientific endeavors (Levy, 1995). Perhaps as a vain attempt to bring some guiding lights to the presentation of the host of new terms pervading environmental research, some definitions, hopefully fairly standing in reference to inclusion or exclusion errors, will be next presented. Phenomenon is any perceivable alteration of the inspected or imagined reality, and once chosen the adequate referential, which is a logical or physical organized locational framework, the arrangement of phenomena under inspection can be represented by two basic primitives, namely entities and events. The mentioned primitives are, essentially, energy manifestations differing by their diverse evolutional change velocity. Thus, entities are slow changing phenomena, perceived mainly in space, while an event is a rapid change phenomenon, mainly perceived under the reality basic parameter time. Can and has been this theoretical framework translated into a pragmatic approach to environmental research? GIS and Geoprocessing, consciously or not, have been erected and are evolving as an affirmative answer to this question. Some other concepts may clarify this contention. Any environmental situation, once having its relevant entities and events initially identified, may be subjected to analysis of the nature of the relationships between those primitives (Xavier-da-Silva, 2007). Events change entities and are by them modified, in an interactive process.

The nature and the intensity of those relationships can and have been investigated by classical statistical procedures (Davis, 1986), (Krumbein and Graybill, 1965), (Snedecor and Cochran, 1980). However, the GIS technology offers a more encompassing view of environmental problems. It generates a digital model of the environment (Xavier-da-Silva, 1982) which presents the phenomena of interest displayed in total correspondence with their real geographical positioning, allowing, consequently, immediate investigation of their Geotopology (Xavier-da-Silva and Zaidan, 2004), proximities and types of dispersion being their most evident

geotopological characteristics. Geodiversity, understood as an overall (physical, biotic and socio-economical) environmental variability, is also automatically displayed and available to analysis at any GIS georreferenced database. Reproducible regionalization procedures can be applied to the environmental data organized in this database, eventually in association with diverse types of distance and other possible measures of interaction. Trend surfaces can be adjusted to the studied geographic area, and easily combined to other represented parameters (land use, for example, to obtain decision support information), and correlations can be searched, based on coincidences of occurrence of specific environmental characteristics.

Although the mentioned techniques belong to a known roll of investigative procedures, a new concept may emerge from the consideration of their joint enunciation: Geoinclusion (Xavier-da-Silva and Marino, 2011). This concept brings some needed understanding and calls attention to adequate processing of the search for environmental knowledge, usually acquired by specialized geoscientists, among other researchers. Thus, a geoincluded environmental investigation associated to natural or antropogenic disasters, for example, has more chances of becoming a useful systematic search for all the relevant risks and associated threats, potentialities and corresponding opportunities which axiomatically occur at any environment It should be emphasized that the objective clearly associated to Geoinclusion is to promote a today most needed adjustment of any relevant environmental alteration to its identified limitations and possibilities, which are exhaustively searchable by geoprocessing procedures.

Every research field can be seen as an assemblage of concepts, methods and techniques aimed at the understanding of a portion of the perceivable reality. A concept is a logical construction, of variable correspondence to reality (exactitude), destined to characterize perceived phenomena. A phenomenon is any perceivable change of reality, and a method can be understood as a particular arrangement of procedures of identification and classification, to be applied to perceived phenomena in order to obtain their man-made images and also to establish deductions, correlations and other logical procedures to explain their occurrence (Xavier-da-Silva and Marino, 2010). Techniques are these mentioned procedures, to be properly arranged through adequate methods.

Our perception of reality can be built through the insertion of the perceived phenomena into a virtual or material structure which usually comprehends the basic parameters of space and time. This encompassing structure can be named a referential and be defined as a perceptive physical or logical framework which allows the systematic recognition of changes in the investigated reality. These changes can be understood as composed of two basic interacting phenomena, namely entities and events. Entities are phenomena perceived mainly in space, while events are phenomena perceived mainly in time, and can be pragmatically considered as responsible for alterations verified in the entities. Events and entities, however, as phenomena, differ by their unequal velocity of alteration in relation to the human time scale, notoriously inadequate to properly consider environmental changes, particularly those of planetary nature. One important contention is that the interplay of those two types of phenomena, once properly analyzed, can usefully depict relevant portions of the perceived or imagined reality.

## 3. About methods

The term Geoprocessing can be accepted as an assemblage of concepts, methods and techniques aimed to changing environmental data into relevant information to be used for environmental understanding, planning and management. As a scientific/technical research field, it propitiates its own methodological advances, but often it is not dealt with as such a composite structure, being slanted towards one side ((excessive association to punctual and disperse technical data) or the other (advancing an unwanted and possibly unfair criticism, as may be the present text case). This loss of focus happens when environmental data handling is geared toward excessively specific goals which, although valid as a way to obtain deep scientific knowledge, may bring only isolated contributions to the much needed environmental understanding. This deficiency is keenly felt when decision support environmental information is sought. In Brazil, at least, environmental research has been stimulated, in many instances, to seek this deep and incomplete understanding of specific environmental processes, as a reflex of the international research scenery occurring at more developed countries. However, environmental research, in terms of understanding the environment, requires more than accumulation of isolated pieces of factual knowledge. Spatial planning and management demand massive idiographic integrated knowledge. Thus, needed investigative tools must be made available, not only to the most illuminated minds, but also to the rank and file researcher. In more palatable words, decision support information about a myriad of specific environments must be massively generated to cope with the abundant and pressing existing environmental problems.

To avoid slanted misunderstandings, it is here clearly stated that there must be freedom of choice in scientific endeavors. But it must also be clearly stated that alternatives do exist in environmental research, other that ultra-specific studies. In the case of Geoprocessing applied to spatial planning, as one of those alternatives, may be proposed the creation of research procedures leading to the creation of decision support information. Some of those methodological structures are briefly presented further ahead.

In the case of Geotechnologies and in Brazil, at least, the conjugation of data, techniques, methods and concepts is heavily slanted toward data acquisition. The strict use of techniques is also emphasized through the frequent simple presentation of papers consisting of tests of techniques. These dominance casts shadows upon the importance of efforts to properly conceptualize and integrate data and, thus, to proceed efficiently the search of the roads and trails leading to real knowledge. In other words, insufficient attention has been given to research concepts and methods. Surely, strict care with data quality must be pursued, particularly in relation to uncertainties generation. It is worth, eventually, to consider some relations between the data handling processes and the conceptual and methodological framework under which those processes are executed.

The ways to gain information (methods) must be clearly perceived, since they are paths to reach useful conclusions. Fully prepared environmental researchers are relatively scarce in Brazil. Unfortunately, the shining qualities of the massive technological advances, together with the generation of abundant data - to be validated, often, for urgent uses - are quite disturbing. Coadunate such an avalanche of needs and uses into a set of procedures properly aimed to relevant goals is not an easy task. Some clues to this objective are tentatively proposed here. They are presented as assemblages of concepts, methods and techniques deserving discussion, and

composing, as a minor contribution, a view of sources of severe uncertainties in environmental studies. Some of those proposed assemblages are:

- Identification, classification and analyses of environments using systematically the concepts of referential, phenomena (entities, events and their relationships) as primitives.
- Increment in the near simultaneous usage of the framework space, time and taxonomy to take advantage of its predictive capacity.
- Intermediate syntheses like environmental impact estimates based on comprehensive digital environmental models.
- Geodiversity, Geotopology and Geoinclusion as concepts to be successively used to environmental investigations.
- Data extraction from areal sources allowing methodic investigation of the advantages and limitations of Punctual Inspection and Generalization as confronted to Locational Integrative Selective Scanning, the basic methods to generate spatialized data such as thematic maps.
- Monitoring, planning, management and zoning of environments based on the use of strictly reproducible criteria.

An example of use of an assemblage similar to those above deserves and receives some more attention. It can be named Vigilance & Control versus Environmental Analysis and Data Integration. These are two investigative, normative and managerial structures stemming from Geoprocessing. Their basic processes and procedures are presented below, and the presence of concepts, capacities, specific methods, techniques or procedures are written in bold letters:

a) **Vigilance and Control** – identification of two types of phenomena: **entities** and **events**, to monitor multiple environmental conditions (**vigilance**) and supply means to interventional procedures (**control**); integrated data storage and creation of time series, to bring **predictive capacity**; specific phenomena **monitoring** (environmental hazards). Under this dynamic **referential**, spatial **planning** and **management** can be efficiently performed, provided that a correct use of Environmental Analysis and Data Integration is made.

b) **Environmental Analysis and Data Integration** – creation of **digital models** of the environment with proper consideration of **Geodiversity** and **Geoinclusion**; practically simultaneous three dimensional analyses (spatial, temporal and taxonomic), allowing **intermediate syntheses**; massive use of exhaustive searching through scanning procedures; specific **geotopological** investigation; **identification** and generation of derived data for **spatial planning** and **environmental management**;

These two aspects of environmental research, calling for integration, bring attention to semantic and other errors, some of them stemming from improper usage of geotechnological resources, usage here understood as much more than a research field dominated by appealing hardwares and softwares.

As a final and probably pretentious remark, attention is called to the elaboration of scientific texts. It is feasible and relevant that scientific papers do not restrain themselves to the presentation of specific advances or detailed description of processes and places. Emplacement of the research possible results, together with problems associated to knowledge dissemination, can and should be considered as significant parcels of a research endeavor. In the present worldwide communication structures, clearly under accelerated and relatively unpredictable future, it is worth to emit value based reasonings, as a counter measure to the frenetic use of

those communication structures for random finalities, mainly for factual information. In this sense, the creation of research procedures, which produce decision support through the proper and needed Geoinclusion, can play an important educational role, by emplacing the resultant knowledge in its adequate and mind stimulating cradle, that is, embedding it into its physical, biotic and socio-economic environmental conditions.

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